Yield Response of Barley to Nitrogen as Affected by Soil Tests for Ammonium and Nitrate-Nitrogen

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Yield response of Conquest barley to nitrogen fertilizer applied at 22, 45, 67 and 134 kg/ha with and without 20 kg P/ha were significantly related by regression analyses to ammonium- and to nitrate-nitrogen in soils of northeastern Saskatchewan. Both linear and quadratic equations obtained from the regression analyses were used to develop tables estimating yield response of barley related to nitrogen fertilizer rates and soil tests for ammonium- and nitrate-nitrogen.

The results indicated that a greater response to nitrogen fertilizer occurred with a given amount of ammonium plus nitrate-nitrogen than with the same amount of nitrate-nitrogen alone. Phosphate fertilizer also significantly increased yield response to nitrogen fertilizers.

Confidence intervals showed that wide variation could be expected in yield response to nitrogen fertilizers. Variation is attributed to differences in soil type, soil moisture and climatic factors among experimental sites.

Table 1

Analysis of Variance Table

Showing Significant Among-Site and

Within-Site Variation of Barley-Yield

Response to N Fertilizer

Source of variation	df	Sum of Squares	m s	F
Among-site				
Regression[+] on nitrate and ammonium-N	4	42,547,744	10,636,936	13.32**
Residual	19	15,168,131	798,323	
Within-site				
Nitrogen	3	10,528,136	3,509,379	28.67**
Phosphorus[≠]	1	3,275,161	3,275,161	26.75**
N x P	3	333,212	111.070	
Residual	161	19,708,681	122,414	

** Significant at 1% probability level.

[+] Partitioning of variation due to regression into single degrees of freedom is shown in Table 3.

[≠] The phosphorus effect is a measure of the increased yield response with nitrogen when phosphate fertilizer is applied.

Table 2

Analysis of Variance Table

Showing how Soil Tests for Nitrogen

Account for Among-Site Variation

in Barley Response to N

Variation	df	Sums of Squares	M S	F	R^2
					%
Nitrate-N	1	26,855,480	26,855,480	33.64**	46.5
$(\text{Nitrate-N})^2$	1	9,950,224	9,950,224	12.46**	63.8
$NO_3^- \times NH_4^+$	1	1,224,824	1,224,824	1.53	65.9
Ammonium-N	1	4,517,216	4,517,216	5.66*	73.2
Residual	19	15,168,136	798,323		

* Significant at 5% probability level.

** Significant at 1% probability level.

Table 3

Yield Response Estimates of Conquest Barley and 90% Confidence Intervals Obtained from Regression Equations Relating to Soil Tests for Ammonium- and Nitrate-Nitrogen

Fertilizer Rate		Ammonium- and nitrate-nitrogen* (μg N/4g soil)				
N	P	10	20	30	40	50
kg/ha		yield increase in kg/ha				
22	0	745 ± 400	516 ± 354	361 ± 352	278 ± 361	
45	0	1483 ± 757	973 ± 669	646 ± 665	500 ± 682	
67	0	1863 ± 865	1234 ± 765	779 ± 760	500 ± 780	397 ± 834
134	0	2506 ± 1313	1621 ± 1161	1011 ± 1154	677 ± 1184	619 ± 1270
22	20	990 ± 462	632 ± 409	413 ± 406	334 ± 417	
45	20	1810 ± 708	1200 ± 626	791 ± 622	584 ± 638	578 ± 685
67	20	2340 ± 818	1512 ± 724	949 ± 719	651 ± 738	619 ± 792
134	20	3268 ± 1183	2142 ± 1047	1383 ± 1040	992 ± 1067	967 ± 1145

* Equivalent amounts of ammonium- and nitrate-nitrogen. Multiply by 2 = lb/ac.

Table 4

Estimates of Yield Response of Conquest Barley and 90% Confidence Intervals Obtained from Regression Equations Relating to Soil Tests for Nitrate-Nitrogen

Fertilizer rate		Nitrate-nitrogen (μg N/4g soil)*				
N kg/ha	P	10	20	30	40	50
		yield increase in kg/ha**				
22	0	499 ± 360	222 ± 352	22 ± 361		
45	0	932 ± 700	483 ± 684	133 ± 703		
67	0	1204 ± 761	537 ± 743	51 ± 764		
134	0	1567 ± 1169	696 ± 1143	53 ± 1174		
22	20	562 ± 454	434 ± 448	306 ± 450	178 ± 461	50 ± 479
45	20	1166 ± 687	718 ± 671	366 ± 690	111 ± 709	
67	20	1470 ± 833	865 ± 814	394 ± 836	55 ± 860	
134	20	1989 ± 1156	1090 ± 1129	413 ± 1161		

* Multiply by 2 = lb/acre.
** Multiply by .9 = lb/acre.